

AS



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/027,251	12/21/2001	Wen Lu	S-2000.1223	9015

7590 02/24/2004

Samuel M. Freund
The Law Offices of William W. Cochran, LLC
3555 Stanford Road
Suite 230
Fort Collins, CO 80525

EXAMINER

PARSONS, THOMAS H

ART UNIT PAPER NUMBER

1745

DATE MAILED: 02/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/027,251

Applicant(s)

LU ET AL.

Examiner

Thomas H Parsons

Art Unit

1745

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-48 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3, 6-15, 18-27, 30-39 and 42-48 is/are rejected.
- 7) ☒ Claim(s) 4, 5, 16, 17, 28, 29, 40 and 41 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

Response to Amendment

This is in response to the Amendment filed 22 January 2004.

DETAILED ACTION

Specification

1. The objection to the disclosure because minor informalities has been **withdrawn** in view of Applicants' Amendment.

Claim Objections

2. The objection to claim 3 because of minor informalities has been withdrawn in view of Applicants' Amendment.
3. Claim 33 is objected to because of the following informalities:
Claim 33, line 1, suggest changing "claim 8" to --claim 25--.
Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The rejection of claims 1-3, 8-15, 18, 21-22, 25-27, 32-39, 42, 45-46 under 35 U.S.C. 103(a) as being unpatentable over McEwen et al. (5,965,054), and further in view of Kobayashi et al. (4,740,436) has been **maintained** as set forth below.

Art Unit: 1745

Claim 1: McEwen et al. disclose a method for inducing a response in a long-lived electrochemical device which comprises the steps of: contacting a working electrode and a counter electrode with an ionic liquid having an anion and a cation; and applying a voltage between the working electrode and the counter electrode, whereby the response is induced in the long-lived electrochemical device (col. 1: 60-col. 3: 20; and col. 6: 7-16).

McEwen et al. do not disclose a conjugated polymer working electrode.

Kobayashi et al. disclose a conjugated positive electrode and a negative electrode composed of an alkali metal, an alkali metal alloy or an electroconductive polymer (a conjugated polymer).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the electrodes of McEwen et al. for the electrodes of Kobayashi et al. because Kobayashi et al. on col. 1: 65-col. 2: 2 and col. 10: 9-25 disclose electrodes that would have provided a high energy density, good reversibility between charging and discharging, a very low self discharging ratio thereby improving the overall performance of batteries.

Claim 2: Because the McEwen et al. combination discloses the same ionic liquid and conjugated polymer as instantly disclosed, the claimed ionic liquid would obviously be stable in the presence of water, and the claimed conjugated polymer would obvious be stable in the presence of the ionic liquid.

Claim 3: Because the McEwen et al. combination discloses the same ionic liquid as instantly disclosed, the claimed ionic liquid would obviously be stable for voltages applied

Art Unit: 1745

between the conjugated polymer electrode and the second electrode in the range from -3 V to +3 V relative to a standard hydrogen electrode.

Claims 8 and 9: McEwen et al. disclose on col. 3: 4-6 that the anion comprises a small, weakly coordinating anion wherein the anion is selected from the group consisting of BF.sub.4.sup.-; and PF.sub.6.sup.-.

Claim 10: McEwen et al. disclose on col. 2: 17-65 that the cation is selected from the group consisting of pyridinium ions, pyridazinium ions, pyrimidinium ions, pyrazinium ions, imidazolium ions, pyrazolium ions, thiazolium ions, oxazolium ions, and triazolium ions.

Claim 11: The rejection is as set forth above in claim 1 wherein Kobayashi et al. further disclose that the conjugated polymer is selected from the group consisting of polyphenylene, polypyrrole, polyaniline, polythiophene, polyacetylene, and derivatives thereof (abs., and col. 7: 21-25).

Claim 12: The rejection is as set forth above in claim 1 wherein Kobayashi et al. further disclose that the conjugated polymer comprises a copolymer selected from the group consisting of phenylene, pyrrole, aniline, thiophene, acetylene, and derivatives thereof (col. 7: 21-25).

Claim 13: The rejection is as set forth above in claim 1 wherein Kobayashi et al. further disclose that the conjugated polymer comprises an oligomer selected from the group consisting of phenylene, pyrrole, aniline, thiophene, acetylene, and derivatives thereof (col. 7: 21-25).

Claims 14 and 15: McEwen et al. disclose on col. 3: 5-8 that the ionic liquid further comprises an organic cosolvent, and wherein the organic cosolvent is selected from the group consisting of cyclic ethers, esters, carbonates, lactones, nitrites, amides, sulfones, and sulfolanes.

Claim 18: The rejection is as set forth above in claim 1 wherein the McEwen et al. further disclose that the electrochemical device comprises a capacitor (col. 3: 18-26), the response comprises storing a charge on the capacitor, and Kobayashi et al disclose on col. 7: 21-25 that the counter electrode comprises a conjugated polymer electrode (electroconductive polymer).

Claims 21 and 22: The rejection is as set forth above in claim 1 wherein further McEwen et al. disclose that the device comprises a rechargeable battery (secondary batter), the response comprises storing and deriving electrical energy from the battery, and Kobayashi et al. disclose on col. 7: 11-21 that the working electrode comprises a metal electrode (Li) having a redox potential lower than the redox potential for the conjugated polymer electrode, and wherein said metal electrode comprises lithium.

Claim 25: McEwen et al. disclose a long-lived electrochemical device comprising a working electrode; a counter electrode; an ionic liquid having an anion and a cation in contact with both the working electrode and the counter electrode; and an electronic power supply for applying a voltage between the working electrode and the counter electrode, whereby the response is induced in the long-lived electrochemical device (col. 1: 60-col. 3: 20; and col. 6: 7-16).

McEwen et al. do not disclose a conjugated polymer working electrode.

Kobayashi et al. disclose a conjugated positive electrode and a negative electrode composed of an alkali metal, an alkali metal alloy or an electroconductive polymer (a conjugated polymer).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the electrodes of McEwen et al. for the electrodes of Kobayashi et al. because Kobayashi et al. on col. 1: 65-col. 2: 2 and col. 10: 9-25 disclose electrodes that would have provided a high energy density, good reversibility between charging and discharging, a very low self discharging ratio thereby improving the overall performance of batteries.

Claim 26: The rejection of claim 26 is as set forth above in claim 2.

Claim 27: The rejection is as set forth above in claim 3.

Claim 32: The rejection is as set forth above in claim 8.

Claim 33: The rejection is as set forth above in claim 9.

Claim 34: The rejection is as set forth above in claim 10.

Claim 35: The rejection is as set forth above in claim 11.

Claim 36: The rejection is as set forth above in claim 12.

Claim 37: The rejection is as set forth above in claim 13.

Claim 38: The rejection is as set forth above in claim 14.

Claim 39: The rejection is as set forth above in claim 15.

Claim 42: The rejection is as set forth above in claim 18.

Claims 45 and 46: The rejection is as set forth above in claims 21 and 22.

(NEW) Claim Rejections - 35 USC § 103

5. Claims 19, 20, 23, 24, 43, 44, 47, 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over McEwen et al. (5,965,054), and further in view of Kobayashi et al. (4,740,436)

Claims 19 and 43: The rejection is as set forth above in claims 1 and 18 above wherein further Kobayashi et al. disclose that the conjugated polymer electrodes comprise porous conjugated polymer films having a conducting metal coating on the side thereof facing away from the ionic liquid (col. 10: 30 – col. 11: 46). Because the electrodes of Kobayashi et al. synthesized in the same manner as instantly discloses (i.e. electrochemically synthesized using the ionic liquid), it would have been obvious to one of ordinary skill in the art at the time the invention was made to have expected the Kobayashi et al. electrodes to be porous.

Claims 20 and 44: The rejection is as set forth above in claims 1 and 18 above wherein further Kobayashi et al. disclose that the conjugated polymer electrodes comprise conjugated polymer films electrochemically synthesized using the ionic liquid and having a conducting metal coating on the side thereof facing away from the ionic liquid (col. 10: 30 – col. 11: 46).

Claims 23 and 47: The rejection is as set forth above in claims 1 and 21 above wherein further Kobayashi et al. disclose that the conjugated polymer electrode comprises a porous conjugated polymer film having a conducting metal coating on the side thereof facing away from the ionic liquid (col. 10: 30 – col. 11: 46). Because the electrodes of Kobayashi et al. synthesized in the same manner as instantly discloses (i.e. electrochemically synthesized using the ionic liquid), it would have been obvious to one of ordinary skill in the art at the time the invention was made to have expected the Kobayashi et al. electrodes to be porous.

Claims 24 and 48: The rejection is as set forth above in claims 1 and 21 above wherein further Kobayashi et al. disclose the conjugated polymer electrode comprises a porous conjugated polymer film electrochemically synthesized using the ionic liquid and having a

Art Unit: 1745

conducting metal coating on the side thereof facing away from the ionic liquid (col. 10: 30 – col. 11: 46).

Because the electrodes of Kobayashi et al. synthesized in the same manner as instantly discloses (i.e. electrochemically synthesized using the ionic liquid), it would have been obvious to one of ordinary skill in the art at the time the invention was made to have expected the Kobayashi et al. electrodes to be porous.

6. The rejection of claims 6, 7, 30 and 31 under 35 U.S.C. 103(a) as being unpatentable over McEwen et al., and further in view of Kobayashi et al. as applied to claims 1 and 25 above, and further in view of Koch et al. has been **maintained** as set forth below.

McEwen et al. and Kobayashi et al. are as applied, argued, and disclosed above and incorporated herein.

The McEwen et al. combination does not disclose that the anion comprises a weakly coordinating anion, and wherein the anion is selected from the group consisting of F^{sup.-}; Br^{sup.-}; I^{sup.-}; NO₃^{sup.-}; N(CN)₂^{sup.-}; RSO₃^{sup.-} where R is an alkyl group, substituted alkyl group, or phenyl group; (CF₃)₂PF₄^{sup.-}, (CF₃)₃PF₃^{sup.-}, (CF₃)₃PF₂^{sup.-}, (CF₃)₃PF^{sup.-}, (CF₃)₃P^{sup.-}, (CF₂SO₃^{sup.-})₂, (CF₂CF₂SO₃^{sup.-})₂, (CF₃SO₂)₂N^{sup.-}, CF₃CF₂(CF₃)₂CO^{sup.-}, (CF₃SO₂)₂CH^{sup.-}, (SF₅)₃C^{sup.-}, (CF₃SO₂)₃C^{sup.-}, [O(CF₃)₂C₂(CF₃)₂O]₂PO^{sup.-}, and CF₃(CF₂)₇SO₃^{sup.-}.

Koch et al. discloses on col. 3: 50-54 that the anion comprises a weakly coordinating anion, and wherein the anion is selected from the group consisting of (CF.sub.3).sub.2PF.sub.4.sup.-, (CF.sub.3).sub.3PF.sub.3.sup.-, (CF.sub.3).sub.4PF.sub.2.sup.-, (CF.sub.3).sub.5PF.sub.1.sup.-, (CF.sub.3).sub.6P.sub.1.sup.-, (CF.sub.2SO.sub.3.sup.-).sub.2, CF.sub.3CF.sub.2(CF.sub.3).sub.2CO.sub.1.sup.-, (CF.sub.3SO.sub.2).sub.2CH.sub.1.sup.-, (SF.sub.5).sub.3C.sub.1.sup.-, and [O(CF.sub.3).sub.2C.sub.2(CF.sub.3).sub.- 2O].sub.2PO.sub.1.sup.-.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the ionic liquid of the McEwen et al. combination by incorporating the anions of Koch et al. because Koch et al. on col. 2:5-8 teach anions that would have provided an ionic liquid with high thermochemical and electrochemical stability thereby improving the overall lifetime and performance of the device.

Response to Arguments

7. The Applicants argue that there is no mention in McEwen et al. of the use of alkali metal salts which are required in accordance with the teachings of Kobayashi et al. And, since the invention of Kobayashi et al. would not operate using the non aqueous electrolyte of McEwen et al., applicants respectively believe that the Examiner has incorrectly combined the teachings of McEwen et al. with Kobayashi et al.

In response, McEwen et al. on col. 3: 20-26 disclose that the nonaqueous electrolytes of the invention are useful in electrical energy storage devices, particularly electrochemical capacitors. These electrolytes can also be used in potentiometric and voltametric electrochemical sensors, photovoltaic devices, fuel cells, **and in primary and secondary**

batteries employing alkali and alkaline earth anode materials so long as the electrolyte contains the cation of the alkali or alkaline earth anode material. Further, the electrolytes of the invention will find use as media for catalysis or ctrocatalysis [sic].

Kobayashi et al. disclose a secondary battery comprising a nonaqueous electrolyte in contact with conjugated positive electrode and a negative electrode wherein the negative (anode) electrode is composed of (i) an alkali metal such as Li, Na or K cations, (ii) an alkali metal alloy, (iii) an electroconductive polymer (conjugated polymer), or (iv) an alkali metal or alkali metal alloy/electroconductive polymer composite, and the electrolytic solution of the secondary battery comprises an alkali metal salt such as Li, Na, and K (abs.; col. 2: 3-12 and 27-68; and col. 7: 6 – col. 8: 10).

Therefore, it would have been obvious to one of ordinary skill in the art a the time the invention was made to have combined the teachings of McEwen et al. with the teachings of Kobayashi et al. because both are concerned with secondary batteries **employing alkali and alkaline earth anode materials and an electrolyte containing the cation of the alkali or alkaline earth anode material.**

Allowable Subject Matter

8. Claims 4, 5, 16, 17, 28, 29, 40, and 41 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Reasons for Indicating Allowable Subject Matter

9. The following is a statement of reasons for the indication of allowable subject matter:

McEwen et al. are directed toward mixtures of a single ionic liquid dissolved in organic solvent(s) wherein the organic solvents are evaluated for their ability to improve specific characteristics (solubility, conductivity, thermal stability) of the electrolyte.

In contrast, the claimed invention is directed toward mixtures of ionic liquid with or without solvent which is neither taught nor suggest in McEwen et al.

Therefore, a search of the prior art of record failed to reveal or explicitly teach alone or in combination what is instantly claimed: in particular,

A method of inducing a response in a long-lived electrochemical device wherein the ionic liquid comprises a mixture of ionic liquids (claim 4);
the ionic liquid comprises at least one ionic solid dissolved in a nonaqueous solvent where the resulting solution being mixed with another ionic liquid (claim 5);

A long-lived electrochemical device wherein the ionic liquid comprises a mixture of ionic liquids (claim 28);
the ionic liquid comprises at least one ionic solid dissolved in a nonaqueous solvent where the resulting solution being mixed with another ionic liquid (claim 29).

For this reason, and for reasons as stated above, claims 4, 5 28 and 29 are patentably distinct from the prior art of record.

Art Unit: 1745

The electrochemical cell of the McEwen et al. combination comprises a conjugated polymer working electrode and a counter electrode in contact with an ionic liquid wherein the response comprises a change in the charging and discharging capacity of the device.

In contrast, the claimed electrochemical cell comprises an actuator wherein the response comprises a change in the actuator which is neither taught nor suggest by the prior art combination.

Therefore, a search of the prior art of record failed to reveal or explicitly teach alone of in combination what is instantly claimed: in particular,

the electrochemical device comprises an actuator, the response comprises a change in stress and strain of the actuator, and the counter electrode comprises a metal electrode (claim 16), and the counter electrode comprises a conjugated polymer electrode (claim 17);

the electrochemical device comprises an actuator, the response comprises a change in stress and strain of the actuator, and the counter electrode comprises a metal electrode (claim 40), and the counter electrode comprises a conjugated polymer electrode (claim 41).

For this reason, and for reasons as stated above, claims 16 and claim 17 which is dependent thereon, claim 40 and claim 41, which is dependent thereon are patentably distinct from the prior art of record.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas H Parsons whose telephone number is (571) 272-1290. The examiner can normally be reached on M-F (7:00-4:30) First Friday Off.

Art Unit: 1745

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Thomas H Parsons
Examiner
Art Unit 1745


Patrick Ryan
Supervisory Patent Examiner
Technology Center 1700